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NOTICE OF ALLOWANCE AND FEE(S) DUE

38834 7590 08/10/2010

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP
1250 CONNECTICUT AVENUE, NW
SUITE 700
WASHINGTON, DC 20036

EXAMINER	
ORTIZ RODRIGUEZ, CARLOS R	
ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 08/10/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/590,704	05/10/2007	Fumihiko Kimura	062916	4387

TITLE OF INVENTION: DESIGN METHOD FOR INDUSTRIAL PRODUCT USING CLOTHOID CURVE, INDUSTRIAL PRODUCTS DESIGNED BY THE DESIGN METHOD, AND METHOD AND DEVICE FOR NUMERICAL CONTROL USING THE CLOTHOID CURVE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	11/10/2010

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

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Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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38834 7590 08/10/2010

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/590,704	05/10/2007	Fumihiko Kimura	062916	4387

TITLE OF INVENTION: DESIGN METHOD FOR INDUSTRIAL PRODUCT USING CLOTHOID CURVE, INDUSTRIAL PRODUCTS DESIGNED BY THE DESIGN METHOD, AND METHOD AND DEVICE FOR NUMERICAL CONTROL USING THE CLOTHOID CURVE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	11/10/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
ORTIZ RODRIGUEZ, CARLOS R	2123	700-097000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

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Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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10/590,704	05/10/2007	Fumihiko Kimura	062916	4387

38834 7590 08/10/2010

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WASHINGTON, DC 20036

EXAMINER	
ORTIZ RODRIGUEZ, CARLOS R	
ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 08/10/2010

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No.	Applicant(s)	
	10/590,704	KIMURA ET AL.	
	Examiner	Art Unit	
	CARLOS ORTIZ RODRIGUEZ	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *04/20/2010*.

2. ☒ The allowed claim(s) is/are *1-3, 5-7 and 9-10*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

1. Claims 1-3, 5-7 and 9-10 are pending.

2. Claims 4, 8 and 11-34 are cancelled.

3. The Amendment to the Specification filed 04/20/2010 have been entered.

4. The Amendment to the Drawings filed on 04/20/2010 have been entered.

Examiner's Amendment

5. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

6. Authorization for this examiner's amendment was given during a telephone interview with Robert Raheja on 07/21/2010.

The application has been amended as follows:

7. Claim 1 has been replaced with the following:

- - A method for designing industrial products by using a computer, comprising:

generating a three-dimensional clothoid curve by the computer; and

designing a shape of said industrial products using the three-dimensional clothoid curve by the computer,

wherein each of a pitch angle and a yaw angle in a tangential direction of said three-dimensional clothoid curve is given by a quadratic expression comprising of a curve length or a curve length variable,

wherein the three-dimensional clothoid curve is generated using the following expressions:

$$P = P_0 + \int_0^s u\,ds = P_0 + h\int_0^S u\,dS, \quad 0 \le s \le h, \quad 0 \le S = \frac{s}{h} \le 1;$$

$$u = E^{k\beta}E^{j\alpha}(i) = \begin{bmatrix} \cos\beta & \sin\beta & 0 \\ \sin\beta & \cos\beta & 0 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}\begin{Bmatrix} 1 \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} \cos\beta\cos\alpha \\ \sin\beta\cos\alpha \\ -\sin\alpha \end{Bmatrix};$$

$$\alpha = a_0 + a_1 S + a_2 S^2 \quad ;$$
$$\beta = b_0 + b_1 S + b_2 S^2 \quad ,$$

wherein

$$P = \begin{Bmatrix} x \\ y \\ z \end{Bmatrix}, \quad P_0 = \begin{Bmatrix} x_0 \\ y_0 \\ z_0 \end{Bmatrix}$$

shows a positional vector at each point on the three-dimensional clothoid curve and its initial value, respectively, the expressions for the three-dimensional clothoid curve when implemented:

assume that the length of the curve from a starting point is s and its whole length is h, said whole length being a length from the starting point to an end point, and produce a dimensionless value S, which is called the curve length variable;

i, j and k are unit vectors in the x-axis, y-axis and z-axis directions, respectively; and

the u is a unit vector showing a tangential direction of the curve at a point P; the $E^{k\beta}$ and the $E^{j\alpha}$ are rotation matrices and represent an angular rotation of angle β about the k-axis and an angular rotation of angle α about the j-axis, respectively,

wherein the $E^{k\beta}$ is referred to as a yaw rotation, while the $E^{j\alpha}$ is referred to as a pitch rotation; the unit vector in the i-axis direction is rotated by an angle α about the j-axis, before being rotated by an angle β about the k-axis, thus producing a tangent vector u in which a_0, a_1, a_2, b_0, b_1 and b_2 are constants. - -

8. Claim 2 has been replaced with the following:

- - The method for designing industrial products according to claim 1, wherein the industrial products being a machine including a mechanism in which a mechanical element having a mass moves and

a trajectory of motion of the mechanical element is designed by using the three-dimensional clothoid curve. - -

9. Claim 3 has been replaced with the following:

- - The method for designing industrial products according to claim 2, wherein:

the machine is a screw device including a mechanism in which a ball as the mechanical element moves,

the screw device comprises a screw shaft having an outer surface on which a spiral rolling element rolling groove is formed, a nut having an inner surface on which a load rolling element rolling groove is formed so as to be opposed to the rolling element rolling groove and a regression path is formed to connect a one end and the other end of the load rolling element rolling groove, and a plurality of rolling elements disposed between the rolling element rolling groove of the screw shaft and the load rolling element rolling groove of the nut and disposed in the regression path, and

the regression path of the screw device is designed by using the three-dimensional clothoid curve. - -

10. Claim 6 has been replaced with the following:

- - The method for designing industrial products according to claim 5, wherein the seven parameters a_0, a_1, a_2, b_0, b_1, b_2 and h of the three-dimensional clothoid segments are calculated so that, between a one three-dimensional clothoid segment and a next three-dimensional clothoid segment, positions, tangential directions, normal directions, and curvatures of both the one and next three-dimensional clothoid segments are made continuous to each other, respectively, at the plurality of spatial points,

wherein the one and the next three-dimensional clothoid segments each being a unit curve consisting of a group of curves produced on the interpolation. - -

11. Claim 7 has been replaced with the following:

- - The method for designing industrial products according to claim 6, wherein: the seven parameters a_0, a_1, a_2, b_0, b_1, b_2 and h of the three-dimensional clothoid segments are calculated by making the number of conditional expressions produced by mutual addition to be made between conditional expressions concerning the tangential directions, the normal directions and the curvatures at both the starting point and the end point and further conditional expressions allowing the positions, the tangential directions, the normal directions, and the curvatures of both the one and next three-dimensional clothoid segments to be made continuous to each other, respectively, at the plurality of spatial points agree with the unknowns of the seven parameters a_0, a_1, a_2, b_0, b_1, b_2 and h of the three-dimensional clothoid segments, whereby the conditional expressions is made agree with the unknowns in terms of number thereof, by specifying the tangential directions, the normal directions and the curvatures at the stating point and the and point among the plurality of spatial points and additionally inserting objective points being interpolated between the spatial points. - -

12. Claim 9 has been replaced with the following:

- - A data storage device characterized in that:

the data storage device stores program for designing a shape of an industrial product which, when executed by a computer, generates,

a three-dimensional clothoid curve in which each of a pitch angle and a yaw angle in a tangential direction is given by a quadratic expression comprising of a curve length or a curve length variable,

wherein the three-dimensional clothoid curve is generated using the following expressions:

$$P = P_0 + \int_0^s u\,ds = P_0 + h\int_0^S u\,dS, \quad 0 \le s \le h, \quad 0 \le S = \frac{s}{h} \le 1;$$

$$u = E^{k\beta}E^{j\alpha}(i) = \begin{bmatrix} \cos\beta & \sin\beta & 0 \\ \sin\beta & \cos\beta & 0 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}\begin{Bmatrix} 1 \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} \cos\beta\cos\alpha \\ \sin\beta\cos\alpha \\ -\sin\alpha \end{Bmatrix};$$

$$\alpha = a_0 + a_1 S + a_2 S^2 \quad ;$$
$$\beta = b_0 + b_1 S + b_2 S^2 \quad ,$$

wherein

$$P = \begin{Bmatrix} x \\ y \\ z \end{Bmatrix}, \quad P_0 = \begin{Bmatrix} x_0 \\ y_0 \\ z_0 \end{Bmatrix}$$

shows a positional vector at each point on the three-dimensional clothoid curve and its initial value, respectively, the expressions for the three-dimensional clothoid curve when implemented:

assume that the length of the curve from a starting point is s and its whole length is h, said whole length being a length from the starting point to an end point, and produce a dimensionless value S, which is called the curve length variable;

i, j and k are unit vectors in the x-axis, y-axis and z-axis directions, respectively; and

the u is a unit vector showing a tangential direction of the curve at a point P; the $E^{k\beta}$ and the $E^{j\alpha}$ are rotation matrices and represent an angular rotation of angle β about the k-axis and an angular rotation of angle α about the j-axis, respectively,

wherein the $E^{k\beta}$ is referred to as a yaw rotation, while the $E^{j\alpha}$ is referred to as a pitch rotation; the unit vector in the i-axis direction is rotated by an angle α about the j-axis, before being rotated by an angle β about the k-axis, thus producing a tangent vector u in which a_0, a_1, a_2, b_0, b_1 and b_2 are constants. - -

13. Claim 10 has been replaced with the following:

- - A computer-readable recording medium, which is for designing a shape of an industrial product, recorded thereon a program which when executed enables a computer to operate as means to design the shape of the industrial product by using a three-dimensional clothoid curve in which each of a pitch angle and a yaw angle in a tangential direction is given by a quadratic expression comprising of a curve length or a curve length variable,

wherein the three-dimensional clothoid curve is generated using the following expressions:

$$P = P_0 + \int_0^s u\,ds = P_0 + h\int_0^S u\,dS, \quad 0 \le s \le h, \quad 0 \le S = \frac{s}{h} \le 1;$$

$$u = E^{k\beta}E^{j\alpha}(i) = \begin{bmatrix} \cos\beta & \sin\beta & 0 \\ \sin\beta & \cos\beta & 0 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}\begin{Bmatrix} 1 \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} \cos\beta\cos\alpha \\ \sin\beta\cos\alpha \\ -\sin\alpha \end{Bmatrix};$$

$$\alpha = a_0 + a_1 S + a_2 S^2 \quad ;$$
$$\beta = b_0 + b_1 S + b_2 S^2 \quad ,$$

wherein

$$P = \begin{Bmatrix} x \\ y \\ z \end{Bmatrix}, \quad P_0 = \begin{Bmatrix} x_0 \\ y_0 \\ z_0 \end{Bmatrix}$$

shows a positional vector at each point on the three-dimensional clothoid curve and its initial value, respectively, the expressions for the three-dimensional clothoid curve when implemented:

assume that the length of the curve from a starting point is s and its whole length is h, said whole length being a length from the starting point to an end point, and produce a dimensionless value S, which is called the curve length variable;

i, j and k are unit vectors in the x-axis, y-axis and z-axis directions, respectively; and

the u is a unit vector showing a tangential direction of the curve at a point P; the $E^{k\beta}$ and the $E^{j\alpha}$ are rotation matrices and represent an angular rotation of angle β about the k-axis and an angular rotation of angle α about the j-axis, respectively,

wherein the $E^{k\beta}$ is referred to as a yaw rotation, while the $E^{j\alpha}$ is referred to as a pitch rotation; the unit vector in the i-axis direction is rotated by an angle α about the j-axis, before being rotated by an angle β about the k-axis, thus producing a tangent vector u in which a_0, a_1, a_2, b_0, b_1 and b_2 are constants. - -

14. Claims 11-34 are cancelled.

Allowable Subject Matter

15. Claims 1-3, 5-7 and 9-10 are allowed.

16. The following is an examiner's statement of reasons for allowance:

While Szu et al. (U.S. Patent No. 5,909,965) discloses designing a shape of an industrial products based on a three-dimensional clothoid curve, Drennen et al. (U.S. Publication No. 2002/0189385) discloses a screw device including a mechanism in which a ball as a mechanical element moves and Hirai et al. (U.S. Patent 6,587,747) discloses curve related mathematical manipulations and expressions, none of these references taken either alone or in combination with the prior art of record disclose a

method/data storage device/computer-readable recording medium for designing a shape of an industrial product including:

(Claims 1, 9 and 10) “generating a three-dimensional clothoid curve using the following expressions:

$$P = P_0 + \int_0^s u\,ds = P_0 + h\int_0^S u\,dS, \quad 0 \le s \le h, \quad 0 \le S = \frac{s}{h} \le 1;$$

$$u = E^{k\beta}E^{j\alpha}(i) = \begin{bmatrix} \cos\beta & \sin\beta & 0 \\ \sin\beta & \cos\beta & 0 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}\begin{Bmatrix} 1 \\ 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} \cos\beta\cos\alpha \\ \sin\beta\cos\alpha \\ -\sin\alpha \end{Bmatrix};$$

$$\alpha = a_0 + a_1 S + a_2 S^2 \quad ;$$
$$\beta = b_0 + b_1 S + b_2 S^2 \quad ,$$

wherein

$$P = \begin{Bmatrix} x \\ y \\ z \end{Bmatrix}, \quad P_0 = \begin{Bmatrix} x_0 \\ y_0 \\ z_0 \end{Bmatrix}$$

shows a positional vector at each point on the three-dimensional clothoid curve and its initial value, respectively, the expressions for the three-dimensional clothoid curve when implemented:

assume that the length of the curve from a starting point is s and its whole length is h, said whole length being a length from the starting point to an end point, and produce a dimensionless value S, which is called the curve length variable;

i, j and k are unit vectors in the x-axis, y-axis and z-axis directions, respectively; and

the u is a unit vector showing a tangential direction of the curve at a point P; the $E^{k\beta}$ and the $E^{j\alpha}$ are rotation matrices and represent an angular rotation of angle β about the k-axis and an angular rotation of angle α about the j-axis, respectively,

wherein the $E^{k\beta}$ is referred to as a yaw rotation, while the $E^{j\alpha}$ is referred to as a pitch rotation; the unit vector in the i-axis direction is rotated by an angle α about the j-axis, before being rotated by an angle β about the k-axis, thus producing a tangent vector u in which a_0, a_1, a_2, b_0, b_1 and b_2 are constants",

in combination with the remaining elements and features of the claimed invention. It is for these reasons that the applicant's invention defines over the prior art of record.

Conclusion

17. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompanying the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance".

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carlos Ortiz-Rodriguez whose telephone number is 571-272-3766. The examiner can normally be reached on Mon-Fri 10:00 am- 6:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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August 5, 2010

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